Spring 2021

CE 332-002: Structural Analysis

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CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

CE 332 – Structural Analysis	Spring 2021
Texts:	Hibbeler, Russell C., Structural Analysis, 10th Edition, Prentice Hall ISBN: 978033942842
Instructor:	Dr. M. Ala Saadeghvaziri, Room 260 Colton Hall, Tel: 973-596-5813, ala@njit.edu ; Office hours: Mondays 11:00AM – 2:00PM; other times by appointment. Please do not be shy and schedule a meeting (for now virtually) to see me when you need help.

Prerequisite: MECH 237 with a grade of C or better. A working knowledge of free body diagrams, equilibrium conditions for force systems and moments. The primary objective is an understanding of the various methods of analyzing determinate and indeterminate beams, frames, and trusses encountered in practice.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

In light of the nature of online tests, you might be asked to meet (at this time virtually) the instructor and explain your solutions. It is at the discretion of the instructors who will be asked to further explain tests' solutions.

Weekly Schedule – to the extent possible:

Week	Topics	Chapter	Homework Problems
1	Introduction, Stability and Classification of Structural Behavior & Analysis	1, 2	To be assigned
2	Analysis of Simple and Compound Beams including Shear and Moment Diagrams	2, 4	
3	Analysis of Simple Frames including Shear and Moment Diagrams	4	
4, 5	Influence lines, Moving Loads, Shear and Moment Envelops	6	
6	Review, Test I		
7	Introduction to Approximate Analysis of Structures	12	Term Project Assigned
8, 9	Deflections: Diagram and Elastic Curve, Moment area, and integration methods	7	
10	Deflection of Trusses: Virtual Work Method (Unit Load Method)	3, 8	
11	Review, Test II		
12	Indeterminate Structures: Consistent Deformation Method	9	
13	Indeterminate Structures: Slope Deflection Method	10	
14	Review		
15	FINAL EXAM		

Course Modules / Topics

I expect you to learn and demonstrate mastery in the following topics/modules:

1. Find reactions and draw shear and moment diagrams for simple and compounded beams (beams with hinges)
    - You must know simple beam analysis from statics and strength of materials
2. Find reactions and draw shear and moment diagrams for simple frames – with and without hinge(s).
3. Understand the concept of influence lines, draw it for basic beam, and use it to determine maxima as asked – maximum shear or moment for beams.
4. Perform approximate analysis (hand solution) of frames and use a software to analyze the same
5. Determine deflection of beams using moment area method
6. Determine deflection of trusses using unit load method (energy method)
7. Analyze and draw shear and moment diagrams for continuous indeterminate beams
    - You must know truss analysis from statics and strength of material

Make sure you review your statics and strength of materials notes. Make sure you always draw free-body-diagram when solving structural analysis problems.

Course Grade

Homework	7 Points
Classwork – you solve in class a problem on each module similar to homework assigned. (roughly every other week – there might be times one every week or 2 in the same week)	28 Points
Mid-Term	20 Points
Final Exam (15th week)	30 Points
Computer Project	15 Points

- The minimum requirements for final letter grades are as follows:
  A = 90.0%, B+ = 85.0%, B = 80.0%, C+ = 75.0%, C = 70.0%, D = 60.0%, F < 60.0%
- The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.
- **No makeup will be given**. Under legitimate, documented and extenuating circumstances, the grade for the final exam will be used for missed assessment.

General Information

Students will be notified well in advance, should there be any modifications or deviations from the syllabus throughout the course of the semester.

Communication: All communication by the Instructor will be done through NJIT's leanrning management system - **Canvas**. It is your responsibility to check e-mail, and the course page on Canvas regularly.

Lectures/Class: This is a synchronous online course, defined, as "Delivery of instruction in which all course activity can be completed online through the learning management system where students are expected to participate in the class at the day and time specified on the NJIT course schedule"

Please turn all cell phones off during class and be respectful to the course instructor and your classmates.

The instructor will assign homework problems and the project. In addition, the students are encouraged to solve many additional problems in the textbook and use many other resources available online. During the term, each student is required to complete the following requirements in addition to the requirements previously mentioned.

1. Self-Study approximate analysis method (Chapter 12)
2. Use of a software of your choice to perform basic analysis.
    a. An intro to Robot will be provided.
        i. This is an analysis and design module within Rivet.
        ii. Download for free from Autodesk, or
        iii. Access department's remotely
    b. This is a free and easy one: https://structural-analyser.com/ with a tutorial by an ex-student https://mediaspace.njit.edu/media/Structural+Analysis+Project/1_r1gwoxb7, or
    c. Use any program of your choice.

Outcomes Course Matrix – CE 332 Structural Analysis

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Provide the ability to understand the behavior of structures under different loading conditions.			
Illustrate basic structural applications and static analysis.	1	1	Weekly homework and quizzes.
Discuss the design of structures.	1	1, 2	Weekly homework and quizzes.
Student Learning Outcome 2: Apply the principles and equations for the analysis of statically determinate and indeterminate analysis in preparation for subsequent design courses.			
Develop various methods of analysis.	1	1, 2	Weekly homework and quizzes.
Provide distinct and detailed examples of how these methods are utilized.	1, 2	1, 2	Weekly homework and quizzes.
Student Learning Outcome 3: Use structural analysis/design software.			
Discuss software tools.	3	1	Lab report.
Analyze assignments using software tools.	1, 7	1	Review of analysis problems.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Revised: 10/8/2019